

Urine Pretreatment History and Perspective in NASA Human Spaceflight

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Urine pretreatment is a technology that may seem to have small mass impacts in future spaceflight missions, but can have significant impacts on reliability, life, and performance of the rest of the wastewater management and recovery systems. NASA has experience with several different urine pretreatment systems, including those flown on the space shuttle, evaluated for NASA waste collection systems or used in Russian commodes on ISS, or developed by NASA or industry as alternatives. Each has had unique requirements for shelf life, operational life, and the life or conditions of the stored, treated urine. Each was evaluated under different test conditions depending on mission, and depending on testing experience developed over NASA's history. Those that were flown led to further lessons learned about hardware compatibility and control. As NASA looks forward to human spaceflight missions beyond low Earth orbit, these techniques need to be evaluated in new light. Based on published design reference missions, candidate requirements can be derived for future systems. Initial comparisons between these requirements and previous performance or test results can be performed. In many cases these comparisons reveal data gaps. Successful previous performance is not enough to address current needs.